Original Research Article

Management of Sunflower Necrosis and Sunflower Leaf Curl diseases by using insecticides

Abstract

A field experiment on management of Sunflower Necrosis and Sunflower Leaf Curl disease was conducted for three years during rabi season at MARS, Raichur. The experiment was planned with seven treatments (six insecticides and one untreated) in three replications for three years i.e., rabi 2016-17, 2017-18 and 2018-19. The insecticides used were imidacloprid 17.8 SL, fipronil 5 SC, triazophos 40 EC, diafenthiuron 50 WP, flonicamid 50 WG and spiromesifen 24 SC. For six treatments (T1 to T6) seed treatment was done with imidacloprid 600 FS and for T7 was maintained without seed treatment. Pooled analysis revealed that the treatment T4 :(Seed treatment with imidacloprid 600 FS@ 5ml/kg seed+ foliar spray with Flonicamide 50WG @ 0.25g/l at 30, 45 and 60 days after sowing) recorded the lesser Sunflower necrosis and Sunflower leaf curl incidence of 4.21% and 4.54% respectively with higher yield of 1630 kg/ha, which is followed by the treatment T5 : (Seed treatment with imidacloprid 600FS @ 5ml/kg seed + foliar spray with Diafenthiuron 50 wp @ 1gm/lit at 30, 45 and 60 DAS) recorded Sunflower necrosis and Sunflower leaf curl incidence of 6.34% and 7.06% respectively with higher yield of 1560 kg/ha and both were at par. Both the treatments recorded B:C ratio of 1.76 and 1.59 respectively. Higher incidence of Sunflower necrosis and Sunflower leaf curl 10.70% and 18.46% respectively and lower yield of 968.4 kg/ha was recorded in untreated control.

Key words: Sunflower Necrosis, Sunflower Leaf curl, Sunflower, Management, imidacloprid, insecticide

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Introduction

Sunflower (*Helianthus annuus* L.), is one of the most important oilseed crops grown throughout the year across India. Sunflower is a newly introduced oilseed crop in India, but it was grown as ornamental plant since ancient times. Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu are the main sunflower growing states of India. In recent years, its cultivation was taken up in non-traditional states like Punjab, Haryana, Uttar Pradesh, Gujarat, Orissa, Madhya Pradesh and Rajasthan. In recent years sunflower area is rapidly declining and among many reasons diseases are one of the major contributors for cropped area reduction. Among viral diseases Sunflower necrosis and Sunflower leaf curl diseases are the important diseases. The Sunflower Necrosis disease was first observed during 1997 at Bagepally (Kolar) near Bangalore (Singh et al., 1997), which occurred in an

epidemic form consecutively for four years (1997-2001) with the incidence ranging from 10-80 per cent in both open pollinated and hybrid varities and Sunflower leaf curl is a serious disease reported in India apart from necrosis (Govindappa et al., 2011). This disease was reported first time on Sunbred-275 during rabi, 2009 at Main Agricultural Research Station, Raichur. It is caused by sunflower leaf curl virus which belongs to Begomo virus group and is infecting many crops. Symptoms of sunflower necrosis disease (SND) comprises of chlorotic and necrotic ringspots, leaf distortion, leaf and stem necrosis and eventual death (Ravi et al., 2001). The causal virus of the disease has been identified as Tobacco Streak Virus (TSV) and shown to be transmitted by thrips in the presence of infected pollen grains (Ravi et al., 2001). The prominent symptoms of the Sunflower leaf curl disease observed were: small size, malformed leaves, leaf and veinal thickening, enations and upward leaf curling. Emerging leaves exhibited yellow discolouration and severe reduction in leaf size. The infected plants were very much stunted when infected at early stages of crop and no ear head was erected. The disease significantly affects the plant height, head diameter, seed weight and oil percentage, etc. (Deepa et al., 2015). It is a whitefly (*Bemisia tabaci*) transmitted virus and the vector attacks numerous fiber (particularly cotton), food, vegetable and ornamental plants apart from sunflower because of its polyphagous nature. A vector plays an important role in transmitting the virus. Keeping the above points in view, the present investigation was carried out to manage the vectors responsible for the transmission of virus. As the chemical management is highly effective and an important way to manage the vectors, this experiment was planned with six insecticides for management of Sunflower Necrosis and Sunflower Leaf Curl disease.

Material and Methods:

A field experiment was conducted at Main Agriculture Research Station, Raichur, University of Agricultural Sciences, Raichur (16°12' N 77° 19'3 E, 407 m elevation) of Karnataka for a period of three seasons from rabi, 2017-18 to 2019-20 under All India Coordinated Research Project on Sunflower scheme. The climate of the region is semi-arid and subtropical. The soil of the area was medium to deep black, low in organic carbon (0.36 %), high in available P2O5 (45 kg ha-1) and available K2O (536 kg ha-1).

Write the method for seed treatment with the insecticide

Randomized Block Design with seven different treatments in three replications. Plot size was maintained as 4.2 x 3 m2 (60 plants per plot), spacing of 60x30 cm and fertilizer schedule of 75- 90-30 NPK kg/ha was followed. Three irrigations were given at different stages i.e., star bud stage, flowering and seed setting in the crop period. All agronomic practices were followed as per package of practices. The soil of the experimental field was black, with pH 8.3 and EC 0.26 dS/m. Seeds of susceptible check (KBSH-44) were obtained from IIOR, Hyderabad. The experiment was laid out in

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Randomized Block Design with seven different treatments in three replications. Plot size was maintained as 4.2 x 3 m2 (60 plants per plot), spacing of 60x30 cm and fertilizer schedule of 75- 90-30 NPK kg/ha was followed. Three irrigations were given at different stages i.e., star bud stage, flowering and seed setting in the crop period. All agronomic practices were followed as per package of practices. The foliar application of insecticides was done as per schedule at 30, 45 and 60 days after sowing.

Write the method for detecting virus severity

Seeds Germination percentage was calculated for each treatment. Data on Sunflower necrosis and leaf curl incidence was recorded at monthly interval starting from sowing date and final data was taken into consideration. Percent of Disease incidence was calculated by using the following formula:

$$\text{PDI (\%)} = \frac{\text{Number of plants infected}}{\text{Total number of plants}} \text{ x } 100$$

Results and Discussion:

The present investigation was carried out using insecticides to manage viral diseases of sunflower. The results indicated that during 2016-17, germination percentage recorded was more than 90% in all the treatments and it was found that there was no significant difference among the treatments. The results are elucidated in Table 1. Among the imposed treatments, less Sunflower necrosis and Sunflower leaf curl incidence of 4.21% and 4.54% respectively was observed in the treatment T5 (Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Flonicamide 50WG @ 0.25g/l at 30, 45 and 60 DAS) followed by the treatment T4 (Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Diafenthiuron 50 WP @ 1gm/lit at 30, 45 and 60 DAS) recorded disease incidence of Sunflower necrosis 5.17% and Sunflower leaf curl disease incidence of 3.85% respectively. Higher Sunflower necrosis and Sunflower leaf curl incidence of 28.75% and 16.26% respectively was recorded in untreated plot. Higher yield of 1630 kg/ha was recorded in the treatment T5, followed by T4 which recorded seed yield of 1560. kg/ha and the treatment T2 recorded that of 1510 kg/ha; however, all these treatments were at par with each other and significantly differed with untreated plot. Less yield of 863.3 kg/ha was observed in untreated plot among all the treatments and it was non-significant with treatments T5 and T4.

During 2018-19 also, similar trend was observed i.e., the treatment T5 recorded the lowest Sunflower necrosis and Sunflower leaf curl incidence of 3.89% and 2.78% respectively followed by the treatment T4 recorded Sunflower necrosis (4.82%) and Sunflower leaf curl (4.10%) both the treatments were at par each other (Table 1) More Sunflower necrosis and Sunflower leaf curl disease incidence of 13.63% and 18.25% respectively was observed in T7 (untreated plot). Regarding yield,

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all the treatments showed higher seed yield over that of untreated plot. However, significant differences were found between untreated plot and T5 treatment.

During the year 2018-19, data (Table 1) indicated that the treatment T5 recorded lesser disease incidence of Sunflower necrosis 3.58% and Sunflower leaf curl 6.99%. Like previous two years results, untreated plot recorded more Sunflower necrosis and Sunflower leaf curl disease incidence of 14.76% and 20.87% respectively.

Pooled analysis results indicated that, Among the imposed seven treatments, the treatment T5 recorded less Sunflower necrosis and Sunflower leaf curl incidence of 4.21% and 4.54% and the same treatment has recorded higher yield of 1630 kg/ha, followed by the treatment T4 whitch recorded Sunflower necrosis (6.34%) and Sunflower leaf curl (7.06%) with seed yield of 1485.6 kg/ha. Higher Sunflower necrosis and Sunflower leaf curl incidence of 10.70% and 18.46% respectively with lower yield of 968 kg/ha was observed in untreated plot. These results indicated that insecticides in the most of the treatments reduced Sunflower necrosis and Sunflower leaf curl incidence, by suppressing the thrips and whitefly (vector) population and among them Flonicamide was found most effective. The results are in accordance with Venkataramanamma et. al.,(2022) where treatment T4 (Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Diafenthiuron 50 wp @ 1gm/lit) was observed with least leaf curl incidence of 23.71% with higher seed yield of 1591 kg/ha followed by T4 Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Flonicamide 50WG @0.25g/l recorded leaf curl incidence of 24.29% with yield 1563kg/ha.

Deepa et al. (2014) conducted an experiment on management of leaf curl incidence of sunflower with insecticides, leaf extracts and bioagents and the results concluded that seed treatment with imidacloprid @ 5 g/kg along with two sprays of imidacloprid @ 0.5 ml/l or triazophos @ 1.5 ml/l were effective in controlling the leaf curl incidence and vector population with increased yield. In the present experiment also, disease reduction was found with insecticides but results of foliar spray with imidacloprid and fipronil were at par with untreated plot. According to Rajasekhar et al. (2018), who tested 8 insecticides against whiteflies of cotton under normal and high density planting system, found that diafenthiuron 50% WP @ 1.25 g/litre was effective in reducing whitefly population followed by flonicamid 50%WG@ 0.3 g/litre and acephate 75 SP@ 1.5 g/ litre, but promising results were not obtained with imidacloprid 17.8% SL and fipronil 5% SC. Shirshikar, 2008 recorded use of imidacloprid for seed treatment along with imidacloprid foliar spray and this treatment were found to be useful in the management of sunflower necrosis disease. In the present study seed treatment with imidacloprid was common for all the treatments and compared with different insecticides. Pandey et al. (2013) who have reported that lowest thrips population and highest bulb yield by applying fipronil. Similarly fipronil and imidacloprid reduced the thrips damage severity and increased the onion bulb yield (Ullah et al., 2010; Gachu et al., 2012). Seed treatment was done with

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imidacloprid 600FS @5g/kg of seed in all the treatments to suppress the sucking pest population in initial days of sowing. The effect of seed treatment was in conformity with Singh et al. (2003), who suggested that seed treatment with imidacloprid (Gaucho 70WS) @5g/kg of seed reduced whitefly (vector population) incidence compared to untreated plot and reduced leaf curl incidence in cotton. Similar results were reported by Chandel et al. (2010).

Similarly, the highest B:C ratio 1.76 was recorded in T5 followed by T2 and T3 recorded 1.62 whereas untreated control recorded lowest B:C ratio of 0.84. Evaluation of various molecules of insecticides against the thrips and whitefly (vector) transmitted Sunflower necrosis and Sunflower leaf curl disease respectively revealed that even though the seed treatment was common in all the treatments, the spraying of insecticide diversified the results. Foliar spray with Flonicamide 50WG @ 0.25g/l at 30, 45 and 60 DAS exhibited less Sunflower necrosis and Sunflower leaf curl disease incidence (4.21% and 4.54% respectively) whereas, foliar spray with Diafenthiuron 50 wp @ 1gm/lit at 30, 45 and 60 DAS resulted in good seed yield. Rational use of these insecticides plays a significant role in management of *Thrips palmi* and *Bemisia tabaci* and consequently Sunflower necrosis and Sunflower leaf curl incidence. Based on the above data, it was concluded that the two chemicals (flonicamid and diafenthiuron) will be effective at recommended concentration for management of vector and hence Sunflower necrosis and Sunflower leaf curl incidence.

Conclusion

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Table 1. Management of viral diseases of sunflower using insecticides

Treatments	Sunflower Necrosis disease (PDI)				Sunflower leaf curl (PDI)			
	2016-17	2017-18	2018-19	Pooled	2016-17	2017-18	2018-19	Pooled
Seed treatment with Imidacloprid 600FS @ 5ml/kg seed and foliar spray with Imidacloprid 17.8SL @ 0.5ml/l at 30, 45 and 60 DAS	14.35 (22.04)	8.21 (16.65)	9.78 (18.17)	9.17 (17.60)	9.89 (18.33)	6.53 (14.80)	16.22 (23.75)	10.88 (18.96)
Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Fipronil 5SC @ 1ml/lit at 30, 45 and 60 DAS	8.79 (16.95)	6.53 (14.81)	7.09 (15.39)	7.47 (15.80)	6.63 (14.92)	5.58 (13.66)	16.81 (24.20)	9.67 (17.60)
Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Trizophos 40EC @ 1ml/lit at 30, 45 and 60 DAS	10.49 (18.73)	5.88 (14.02)	8.53 (16.82)	8.30 (16.68)	8.28 (16.73)	5.24 (13.33)	15.99 (23.57)	9.84 (17.84)
Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Diafenthiuron 50 wp @ 1gm/lit at 30, 45 and 60 DAS	7.94 (15.99)	4.82 (12.68)	6.25 (14.44)	6.34 (14.48)	5.98 (14.15)	4.10 (11.69)	11.09 (19.46)	7.06 (15.10)
Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Flonicamide 50WG @ 0.25g/l at 30, 45 and 60 DAS	5.17 (12.88)	3.89 (11.36)	3.58 (10.61)	4.21 (11.73)	3.85 (11.31)	2.78 (9.59)	6.99 (15.33)	4.54 (12.08)
Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Spiromesifen 24SC @ 1ml/l at 30, 45 and 60 DAS	12.99 (20.83)	4.59 (12.36)	4.39 (12.07)	7.32 (15.65)	7.85 (16.27)	3.90 (11.39)	13.95 (21.93)	8.57 (16.53)
Control	28.75 (32.37)	13.63 (21.66)	14.76 (22.48)	10.70 (19.06)	16.26 (23.78)	18.25 (25.29)	20.87 (27.18)	18.46 (25.42)
S. Em.±1	2.39	0.39	1.44	1.04	1.30	0.88	1.55	1.01
C. D. at 5%	7.36	1.21	4.43	3.21	4.00	2.72	4.78	3.11

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Table 2. Seed yield (Kg/ha) and B: C Ratio under various treatments

Treatments	Yield (Kg/ha)				B:C Ratio
	2016-17	2017-18	2018-19	Pooled	
Seed treatment with Imidacloprid 600FS @ 5ml/kg seed and foliar spray with Imidacloprid 17.8SL @ 0.5ml/l at 30, 45 and 60 DAS	1248.33	1363	1167	1259.4	1.22
Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Fipronil 5SC @ 1ml/lit at 30, 45 and 60 DAS	1510.83	1455	1311	1425.6	1.62
Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Trizophos 40EC @ 1ml/lit at 30, 45 and 60 DAS	1364.67	1542	1268	1391.5	1.62
Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Diafenthiuron 50 wp @ 1gm/lit at 30, 45 and 60 DAS	1560.00	1648	1249	1485.6	1.59
Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Flonicamide 50WG @ 0.25g/l at 30, 45 and 60 DAS	1630.00	1750	1668	1682.6	1.76
Seed treatment with Imidacloprid 600FS @ 5ml/kg seed + foliar spray with Spiromesifen 24SC @ 1ml/l at 30, 45 and 60 DAS	1455.00	1685	1454	1531.3	1.58
Control	863.33	1025	1017	968.4	0.84
S. Em.±1	102.8	100.04	96.13	81.49	
C. D. at 5%	316.75	297.22	296.20	251.1	

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